The need for training materials on a continuing basis is required. AASSP/PSA should request a permanent institution such as CIMMYT or ICARDA to collaborate in the production of manuals that can be used in training and extension. This process would assure a permanent record and access to the materials developed. CIMMYT has often produced materials for multi-language processing. CIMMYT and ICARDA are in a position to do the layouts and necessary diagrams, figures and text. This could then easily be translated by AASSP/PSA personnel in cooperation with SCA or other organizations. This project could be completed in less than two years.

The value of video cassettes in training inside Afghanistan should be given serious consideration. They can be produced at a nominal cost and they represent a powerful training tool.

There will be a need for continued training of young scientists. They should be selected and sent to training courses whenever possible. Both ICARDA and CIMMYT have training opportunities which should be used.

In the longer term, the need for a continuing stream of varieties remains. This involves the research and extension of on-farm and demonstration aspects. AASSP/PSA should consider the need to have a core of extension personnel in place to continue activities recommended in the 1990 report on wheat (Saari, 1990). The activities listed in the above report are still valid.

Another long term issue is the need to develop varieties which can replace *Pak 81* and *Pirsabak 85*. The use of a shuttle breeding approach was suggested earlier in the report. AASSP/PSA should support both Pakistani and Afghan researchers in this effort. If legal or administrative policies do not allow the support for both, then provisions to support at least the Afghan scientists should be considered.

5.3 Areas of Collaboration

The AASSP/PSA extension effort should continue to concentrate on cooperating with SCA. AASSP/PSA has the capacity to use much of the information gained by the researchers involved with SCA activities, and a coordinated effort should be made to lay out on-farm trials that test some of the new varieties or techniques. Simple on-farm demonstrations should also be encouraged for the various crops. In the case of wheat, improved seed and the package of practices that optimize yield should be concentrated upon.

Other technologies which can be borrowed need evaluation. AASSP/PSA is in a position to encourage such activities.

Seeds of good quality are still the first step in the process of increasing production. Assessment of the proper varieties and their subsequent multiplication is a major contribution to productivity. Seed multiplication of newer varieties has lagged in many countries which have not suffered the consequences of war. The situation in Afghanistan is even more difficult and AASSP/PSA could assist production by promoting a new level of seed production at the farm level. Other cross border organizations would probably welcome the opportunity to participate in such an activity.

It is unrealistic to believe that production increases will be possible without inputs. Afghanistan soils are depleted and in order to benefit from new varieties inputs are necessary if optimization of the effort is to be achieved. In some cases, long term rotations will possibly improve production potential but this will take a long term prospective. In the near term, basic inputs of fertilizer, nitrogen and phosphorus will be needed. Encouragement of the supply side of inputs should be supported.

Pakistan agriculture and research is vital to the Afghanistan situation. Pakistani systems offer a supply of information and materials. It will remain a source of backstopping for the research component in wheat. Wherever possible, collaborative efforts should be promoted.

The international institutes such as ICARDA, International Corps for Research Institute for Semi-Arid Tropics (ICRISAT), International Rice Research Institute (IRRI) and CIMMYT represent long term resource and backstopping agencies. They have information, materials and training continuity which should be utilized to the maximum. Training of young scientists and short visits by scientists can be useful for ongoing efforts to re-establish Afghanistan's research capabilities in the future. Provisions should be made for such training opportunities and visits.

Other NGOs are dependent upon other organizations for seed and lack the resources and backstopping to produce their own. AASSP/PSA could encourage them to take up seed production at the farm level using the concept of Farmer Improved Seed. Most NGOs would welcome AASSP/PSA leadership on such an issue.

APPENDIX I

OUTLINE OF TOPICS COVERED IN WORKSHOPS

General outline of the topics covered in lectures to workshop trainees by E. E. Saari.

I. Germplasm: Variety/Cultivar selection.

1. Spring wheat, winter wheat and facultative wheat
2. Elevation considerations
3. Yield, stability, diseases and pests, and quality
4. Wheat seed requirements and considerations.

II. Agronomy: Fundamentals of wheat production with semi-dwarf wheats.

1. Seed quality
2. Establishment of a proper plant population
3. Role of the cultivar
4. Seed bed preparations
5. Irrigated versus rainfed considerations
6. Rainfed planting
   6.1. Soil moisture and seed germination factors
   6.2. First rains and seeding considerations
   6.3. The fallow system
7. Irrigated planting
   7.1. Regulation of sowing date
   7.2. Soil characteristics and moisture
   7.3. Excessive moisture considerations
8. Seed germination process and plant populations

9. Sowing methods
   9.1. Broadcasting
   9.2. Machine

10. Sowing dates and rates
   10.1. Cultivar considerations
   10.2. Rotation influences
   10.3. Irrigation and sowing considerations
   10.4. Delayed sowing and losses

11. Irrigation of the crop
   11.1. Critical stages
   11.2. Water demands

12. Fertilizer application
   12.1. Nitrogen - Irrigated and rainfed
   12.2. Phosphorus - Irrigated and rainfed
   12.3. Other and minor elements
   12.4. Deficiencies and toxicities
   12.5. Fertilizer response curves
   12.6. Formulations
   12.7. Application - time(s) and methods
   12.8. Rotations

13. Soil considerations
   13.1. Physical
   13.2. Chemical
   13.3. Salt problems
   13.4. Soil testing

14. Weed control
   14.1. Broadleaf and narrow leafed weeds
   14.2. Crop competition
   14.3. Cultivation practices
   14.4. Rotations
   14.5. Chemical control
   14.6. Application methodology

III. Diagnosis of production problems: Biotic and Abiotic

1. Diseases, causes, losses, epidemiology and control.
   1.1. Rust diseases
   1.2. Smut and bunt diseases
   1.3. Other foliar diseases
   1.4. Root rots
   1.5. Spike diseases
   1.6. Bacteria
   1.7. Viruses
   1.8. Nematodes
   1.9. Resistance breeding verses chemical

2. Insects, cycles, losses and control
   2.1. Sun pest
   2.2. Grasshoppers and locusts
   2.3. Armyworms
   2.4. Cereal leaf beetle
   2.5. Fruit and Hessian fly
   2.6. Sawfly
   2.7. Wireworms
   2.8. Grubs
   2.9. Mites and midges

3. Abiotic factors
   3.1. Excess water
   3.2. Drought
   3.3. Winter kill and ice damage
   3.4. Freezing and hail damage
   3.5. Heat damage
   3.6. Soil physical factors
   3.7. Soil chemical and salt
   3.8. Herbicide damage
   3.9. Mineral deficiencies and toxicities

D R A F T

REPORT ON WHEAT PRODUCTION IN AFGHANISTAN: AN ASSESSMENT OF POTENTIALS AND PROBLEMS

Prepared by Eugene E. Saari, Pathologist/Breeder, CIMMYT Wheat Program, P.K. 39, Emek, Ankara, Turkey.

Summary:

- The war in Afghanistan has disrupted all facets of life and the agriculture sector has lost approximately 50 percent of its productive capacity.

- Infrastructure and institutional activities in the agricultural sector are either reduced or non-functioning. Currently, there is little agricultural research being conducted and there is no seed production or multiplication of crop species.

- Almost all crops have realized a reduction of 50% in productivity and this includes wheat, by far the dominant crop in Afghanistan. In addition, there has been a loss of seed stocks and the quality has deteriorated.

- Development Alternatives Incorporated (DAI) has signed a contract with USAID to: 1) assist in restoring agricultural production; 2) develop a marketing system for input supplies and agricultural output and; 3) help broaden the rural economic base through the Afghanistan Agricultural Sector Support Program/Private Sector Agribusiness (AASSP/PSA).

- Two of the operational units of the AASSP/PSA will be the Program Planning and Analysis (PPA) and Agricultural Development and Training (ADT) units. They will carry out many of the program activities of the project.

- E.E. Saari, from CIMMYT (International Maize and Wheat Improvement Center, Mexico) was requested to study the wheat production situation in Afghanistan and develop a set of recommendations for: 1) wheat seed needs for AASSP/PSA and a program to help supply them, and 2) outline activities that AASSP/PSA could undertake to increase wheat productivity.

Recommendations:

- The wheat cultivars recommended for the different zones in Afghanistan should be used by AASSP/PSA.

- The seed replacement rate for the product area should start at a modest level between one and two percent, or at a quantity level of 1,000 to 1,500 tons of seed for the 1990-91 crop cycle.

- The seed required should be obtained from either FAO/UNHCR or contract purchased from the private sector in Pakistan. This effort should be undertaken

immediately for the coming season, 1990-91. In lieu of certified seed availability, contracting for quality improved seed should be arranged. There would still be time for scouting and selecting the better fields and arranging for roguing and processing.

- Time for contracting certified seed for the coming crop cycle has passed. Immediate steps must be taken to assure improved seed and contract seed for next year.

- The future purchases of wheat seed for the project area should be for the irrigated regions and split 80 to 90 percent for spring types and 10 to 20 percent for winter types.

- The acreage of spring sown wheat (March/April) is small in the project area. The purchase and distribution of *Sonalika/Blue Silver* at this time probably is not feasible but should be re-evaluated in the coming seasons.

- The VITA organization has contracted the purchase of approximately 500 tons of seed in the project area. DAI should try to honor this commitment in order to maintain the good will of the farmers in the area.

- Seed quality should be maintained at the accepted international standards for certified seed, and seed standards for improved seed in Afghanistan should be developed.

- The VITA contracted seed should be scouted and the necessary steps for roguing and handling of the crop should be done so the best possible standards for locally produced improved seed are established.

- Training of the personnel who will serve as scouts or purchase agents for seed re-purchase should be arranged.

- Seed storage to maintain the quality of purchased seed in the project area must be arranged.

- Seed treatment possibilities for the purchased seed should be explored using the fungicide **Vitavax** which will control two important wheat diseases in Afghanistan. It is also a relatively safe chemical to use even at the farm level.

- Seed cleaning and treatment equipment should be considered for each bazaar unit of the PSA.

- The synchronization of the delivery of other inputs with the seed should be given priority consideration.

- o The use of mini-kits to distribute seed, fertilizer and other necessary inputs should be considered as an activity of the PSA and ADT jointly. The expense of quality seed distribution cannot be justified without the supply of fertilizer.

- o There is a need for new cultivars and the ADT unit should participate in the on-farm testing of these varieties and new advanced lines identified by the research group.

- o As new cultivars are identified, on-farm demonstrations should be developed by the ADT unit.

- o The ADT unit of the AASSP/PSA should develop extension type information that will be conducive to wheat production.

- o On-farm trials should be outlined and conducted taking into account important variables for wheat production. Coordination of experiments should be done in conjunction with research personnel and PPA.

- o Farm demonstrations should be planned and executed to show farmers proven technologies for increasing wheat productivity.

- o Training workshops should be organized to educate farmers in the application of new or different technologies.

- o The value of using a mini-kit type of extension package should be considered as a means of dispersing technologies about subjects other than seeds.

- o Survey and monitoring activities should be undertaken in order to develop baseline data and provide a feed-back system for assessment.

- o Young Afghans should be identified for training opportunities with various crops available at the International Agricultural Research Centers.

- o There is severe food shortage and an outbreak of insects (locust and sunn pest) in the northern provinces. This is an emergency situation, and AASSP/PSA should review its options to help through supplying seed, fertilizer and pesticides.

<u>Introduction:</u>

The AASSP/PSA is a comprehensive assistance project for the rehabilitation of the Afghan rural sector. It involves an integrated approach to reviving agricultural productivity and stimulating economic development (DAI, 1989). There are several operational units

under the Project. The Private Sector Agribusiness (PSA) component will assist the private sector to supply inputs, equipment and commodities, and explore credit and export opportunities. The Agricultural Development and Training (ADT) component will endeavor to test and demonstrate cropping technologies, conduct extension activities and provide training opportunities. One objective will be to improve wheat production capabilities by supplying technology, seeds, inputs, equipment, credit, marketing support and training opportunities to both resident and returning refugee farmers (DAI, 1989; Greenham, 1989).

Eugene E. Saari, a wheat specialist from the staff of the International Maize and Wheat Improvement Center (CIMMYT), was requested to conduct a study of the wheat production situation in Afghanistan, and 1) determine the needs of the farmers for wheat seed and how to supply them, and 2) recommend activities that AASSP/PSA should undertake to increase wheat production and farm productivity.

Wheat Production in Afghanistan:

Wheat is the most important crop in Afghanistan. The statistics from before the war, 1978, placed the wheat acreage at approximately 2.3 million hectares. The irrigated wheat area figures range from 40 to 65 percent with approximately 50 percent of this acreage being irrigated. Production was estimated at 2.6 million metric tons which represents an average yield of 1.1 tons per hectare (ANON., 1989; FAO, 1985; SCA, 1988). The irrigated area accounted for almost 80 percent of the total wheat production. This production was considered sufficient to meet national requirements, except for minor imports of wheat recorded for seed purposes (Gul, 1989).

The ensuing war years have seen a major displacement of farmers and a reduction in the area sown to all crops. There has also been a loss of irrigation capacity, a destruction of roads and a subsequent loss in the availability of inputs. As a result the production capacity of the agricultural sector has been reduced dramatically. The reduction in wheat production varies depending upon the area involved, but current estimates are that total production capacity in the irrigated and rainfed areas has been reduced by 50% (SCA, 1989, 1989). Similar figures are quoted for all crops. Losses in productivity of the other cereals were calculated at 46% for maize, 55% for rice and 26% for barley.

The most common wheat grown in Afghanistan is breadwheat. There is a relatively small acreage sown to other types such as club and durum. Wheat is consumed primarily as a flat bread called nan, which is the basic staple of the Afghan diet. Estimates place consumption between 175 and 200 kg per person (SCA, 1989; Hepworth, 1988; Noori, 1989).

I. SUMMARY OF RECOMMENDATIONS

E. E. Saari from the International Maize and Wheat Improvement Center (CIMMYT), Mexico, spent from January 11 to 29, 1992 in Pakistan as a consultant to AASSP/PSA. Between January 12 and 23, he assisted in the training of Afghanistan extension workers in Peshawar. The remainder of the period was used to study and discuss the issues outlined in the Scope of Work. The recommendations put forth are detailed in the following section.

Recommendations

- Seeds of improved varieties of wheat are still scarce in Afghanistan. There is a need to increase the rate of internal seed production. The recognition of a new class of wheat seed is suggested. This "Farmer Improved Seed" could be certified by extension personnel and the same individuals could promote the seed in the community. A campaign of "Improve Your Own Seed " also could be promoted.

- Training materials are in short supply. An effort to produce a "Wheat Manual" with fundamental details including good diagrams and pictures would be useful for future extension personnel. This manual could be done jointly with CIMMYT in collaboration with other non-government organizations (NGOs). A manual produced in such a manner would be widely acceptable and secure for future reference. The possible use of video training materials should also be given consideration.

- Training is a continuing need. There are many levels of training and extension personnel who should continuously be upgrading their information and materials. Use of short term training and visits to International Centers, such as CIMMYT and the International Center for Agriculture Research in the Dry Areas (ICARDA), should be supported.

- On-farm demonstrations and trials should be coordinated with information being developed by a research group. In addition, the accepted package of practices for optimizing wheat production should be demonstrated in farmers' fields.

- Tests of new varieties of wheat should be undertaken using the advice of the research group efforts of the Swedish Committee for Afghanistan (SCA), Pakistan researchers and other organizations.

Because of war disruption and natural calamities, food shortages are being realized in some areas and malnutrition or starvation are considered possibilities (Frontier Post, 1990; Pakistan Times, 1990; Tacon, 1989).

The winter crop of 1988-89 was a drought cycle resulting in below average yields, particularly in the northern half of the country. Severe infestations of the insect pests, locusts and sunn pest, occurred in much of this same area causing additional reductions in yield. In some cases crop failure was recorded (Baquee and Tacon, 1989; Tacon, 1989).

Basic seed stocks of many crops have been lost and in food deficient areas consumption of seed stocks has been noted (SCA, 1988; Tacon, 1989). In addition, loss of quality has occurred over the years. There is a critical need to replenish stocks with quality seed of the new varieties. The supply of quality seed will be vital to any recovery in production capacity. To stimulate production other inputs and support services will also be required. Seed, however, will determine the genetic or biological limits and for this reason the new high yielding cultivars should be made available to both the refugee and resident farmers.

Increasing Wheat Production:

In order to have a successful wheat production program quality seed of the proper variety must be made available along with a package of practices. The advantages of new cultivars cannot be fully realized without the application of good crop management practices and a supply of critical inputs. This combination must be demonstrated at the farm level through well planned extension efforts. Necessary inputs, equipment and credit must be made available. In a market-oriented situation a price support system for the produce or a floor price for production must be established. In the current situation a number of organizations dealing with the Afghanistan agricultural rehabilitation argue that an emergency exists. There is a feeling that in order to insure even distribution of scarce inputs to all classes of farmers, seed, fertilizer and other necessary inputs must be distributed free of charge. When this crisis period has passed, however, a set of policies will need to be developed for a more market-oriented situation.

The seed supply and other technical issues which are considered important to wheat production are touched upon in the following sections. Some of the points may be of value in determining seed needs, in development of recommendations or the package of practices, and in planning of on-farm trials and demonstrations.

Wheat Varieties: Which, Where, Why and When:

The vast majority of wheat grown in Afghanistan is autumn sown. The fall sown wheats probably occupy 90 to 95 percent of the acreage. Both spring and winter habit wheats can and are sown at this time. Which type is sown is determined by the temperature during the growing season. Autumn sown spring wheats are estimated to occupy 80 percent or more of the total. The winter type wheats are grown at higher elevations (ca. 1800 meters) and this area is estimated to occupy 20 percent or less of the total wheat acreage.

There is a considerable area sown in the winter and/or spring time because moisture for autumn sowing is not sufficient. Rainfall is often late in arriving so land preparation is delayed and cold temperatures are not conducive to sowing. The necessity for weed control, especially grass weeds such as wild oats by means of cultivation is another factor that often delays sowing in some regions. The area sown to spring wheats in the AASSP/PSA plots has been relatively small although this practice has been gaining because the new high yielding spring wheats mature early and the yields surpass the old local varieties. The majority of the spring sown wheat has been in the northern half of the country (SCA, 1989).

The varieties recommended for the different wheat zones in Afghanistan are listed in Table 1. The selection of these cultivars was based on earlier results and recommendations (Fitzherbert and Stevens, 1989; Hepworth, 1988; Saari, 1989; Stevens, 1989). In summary, the varieties recommended for immediate use had to satisfy several basic criteria. They had to be proven and safe cultivars tested under Afghanistan conditions and be available in commercial quantities. A safe variety was considered to be: 1) resistant to the economically important diseases present and/or 2) winter hardy, so winter killing was avoided.

The varieties presented in Table 1. were also recommended for future use and plans were made to actively multiply them outside of Afghanistan (FAO, 1989; Fitzherbert and Stevens, 1989; Steven, 1989). Some of the cultivars have been or are being tested under conditions in Afghanistan but were not available in commercial quantities. Still others which could have been recommended were not available in any significant quantity.

There are a number of promising wheat lines still in the testing stage. A number of experimental trials with new breeding lines have been sown in Afghanistan and Pakistan (Dr. Azum Gul, SCA, Peshawar, Pakistan, personal communication). Based on future results the best lines could be promoted, and initial multiplications started. These lines should be considered for broad scale testing and demonstrations. These experiments will, we hope, produce the next generation of wheat cultivars.

Table 1. Wheat cultivars recommended for immediate commercial use for autumn or spring sowing in the crop cycle of 1989-90 in Afghanistan, and varieties for multiplication for future use in the different zones (adapted from FAO, 1989; Fitzherbert and Stevens, 1989; Saari, 1989; Stevens, 1989).

Sowing Month	Type/ Habit	Elevation Meters[1]	Irrigated Rainfed[2]	Rainfed[3]
			Zone 1	Zone 2
Sept./Oct.	Winter	Higher (>1800)	*Bezostaya*	Local/(Zarghoon)
			Zone 3	Zone 4
Nov./Dec.	Spring	Lower (<1800)	*Pak 81* *Pirsabak 85*	Local
			Zone 5[4]	
Jan./Feb.	Facultative/ Spring	Lower (<900)	Local, *Sonalika, Blue Silver, (Khyber 87), (Pak 81)*	
			Zone 6[5]	
Mar./Apr.	Spring	Higher (>900)	*Sonalika, Blue Silver* Local, *(Khyber 87), (Pak 81)*	

1 The elevation suggested is approximate and will vary depending upon temperature which will be influenced by exposure, direction, etc.
2 Irrigation or rainfall either or both combined above 400 mm.
3 Rainfall below 400 mm.
4 Sowing occurs late due to rainfall patterns. Traditional facultative type wheats have been sown but some of the early maturing spring habit wheats show promise.
5 Due to late rains and cold or freezing temperature and/or snow cover, sowing is not possible until the early spring season.

Wheat Seed Requirements:

Statistics of an area, production and yield for Afghanistan cannot be considered precise and vary depending upon the source. The statistics for crops and production over the last decade are much more variable. For purposes of extrapolation, figures from varied sources have been used. The figures in Table 2. (Anonymous, 1989; FAO, 1985; SCA, 1989, 1988; Hepworth, 1988; Lea, 1989) suggest that the wheat area has been reduced slightly but production has remained the same with a slight increase in productivity.

In contrast, the results from the Agricultural Survey of Afghanistan, ASA (SCA, 1988, 1989) indicate that a decrease in area and production would be more realistic. The acreage, production and yield for 1987, were calculated using the ASA results. The loss in productivity is substantial and the low yield average of less than 900 kg/ha would suggest that increasing production with nominal inputs should provide large returns. Some caution should be taken in using the calculated yield of 807 kg/ha since loss values in area and production are confounded for area. The value probably represents the low end of the yield range whereas the pre-war average yield of 1130 probably represents the high end.

The AASSP/PSA will initially have responsibility for 16 target provinces in Afghanistan. They are located in the south and eastern half of the country (See Table 2. and map of provinces on page 44.). The province of Paktika was created from parts of Paktia and Ghazhni provinces. No reliable statistics or breakdown for the crop areas were readily available for the three provinces. The provincial area figures provided by Anonymous (1989) for winter cereals were used to develop the aggregate wheat acreage. The wheat acreage figures were calculated by using an estimate of 80 percent wheat coverage (See Table 2.).

Table 2. Wheat area ('000 ha), yield (kg/ha) and production ('000 tons) in Afghanistan calculated from various reports (FAO, 1985; SCA, 1988, 1989; Lea, 1989).

Year	Area	Yield	Prod.	Area	Yield	Prod.
1987[1]	2,348	1,130	2,652	NA[2]	NA[2]	NA[2]
1986[3]	2,050	1,320	700			
1987[3]	2,000	1,370	2,750	1,644[4]	807[4]	1326[4]
1988	2,100	1,330	2,800			

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1 Official figures 1978 from SCA (1988).
2 Not applicable.
3 Government figure from Lea, 1989.
4 From SCA, 1988, 1989; Production reduced 50% & area 30%

Table 3. Approximate pre-war irrigated and rainfed wheat area of the 16 target provinces of the AASSP/PSA and grouping for time of program initiation: I. Fall, 1989; II. Spring, 1990; III. Summer, 1990 (from Anonymous, 1989; DAI, 1989).

Group	Province	Area (hectares)	
		Irrigated*	Rainfed*
I	Kandahar	83,100	15,800
	Ghazni	77,400	2,000
	Kunar	20,900	1,200
	Paktika	na	na
II	Helmand	95,300	100
	Zabul	41,300	7,300
	Laghman	26,500	600
	Logar	16,900	6,900
	Wardak	17,900	700
III	Uruzgan	91,600	1,700
	Bamyan	16,100	2,700
	Kabul	35,500	4,000
	Kapisa	24,200	200
	Nangarhar	49,700	7,200
	Paktia	35,300	12,500
	Parwan	22,100	5,400
Subtotals		653,800	68,300
Percent		90	10
Grand Total		722,100	

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* Figures rounded to the nearest 100.

na Not available. Paktika was created from parts of Paktia and Ghazni. Totals include acreage of Paktika.

The total calculated area of wheat in the 16 provinces of the AASSP/PSA comes to 722,100 hectares. The annual seed requirement for this area would be 106,208 metric tons if the area figures are correct and the differential seeding rates for types of wheat are included (See Table 2.). In order to determine how much quality seed to supply to farmers, some goals must be decided as to the area to be serviced and the seed replacement rate in years. The infusion of new seed should maintain its relative purity and quality with the average farmer for a period of five to seven years. Ideally, a more frequent turnover of seed would be desirable but may not be feasible (See Table 2.). Many farmers will prefer to take seed from neighbors rather then seed merchants. There will also be a number of farmers who will continue to grow old varieties for an assortment of reasons (Ahmad et al., 1989; Azee et al., 1989).

Seed Multiplication:

Most countries have a seed multiplication and certification operation. In some countries it is entirely in the hands of the government while in others the private sector plays a significant role. The involvement of the private sector also tends to concentrate on specific crops. The certification of seeds invariably remains a government function in all countries. Afghanistan had a modest seed multiplication program before the war. It is currently not functioning. All improved seeds at the certified level or above will have to be grown outside Afghanistan until some future date. The research program and seed multiplication capabilities within Afghanistan will have to be restored before certified seed can be produced within the country.

Eventually it will be necessary for Afghanistan to re-establish its research program. The research function is essential for varietal development and crop recommendations. The research program is also held responsible for maintaining cultivar purity and seed multiplication at the pre-certification stages. This is vital for those crops which the private sector does not feel are investment worthy. The growing of certified seed can be done by the private sector if it is allowed to operate at a profit. Seed multiplication can also be successfully accomplished through farmer organizations or contracts. The inspection and certification operations remain the duties of government agencies for obvious reasons.

The purity, viability and other quality factors of seeds require the establishment of standards at the various levels of production. Good regulations are worthy of achieving, but excessive standards are not possible to honor. Lax standards destroy the confidence of the farmers and the market.

Table 4. Calculation of approximate annual seed requirements for autumn sown irrigated and rainfed wheat crops in the 16 initial target provinces of the AASSP/PSA and total requirements for Afghanistan using the acreage figure reported by Anonymous (1989) and assumptions explained in the text.

Area / Condition / Type	Total Area (ha)	% Of Area	Seed# Rate kg/ha	Total Seed (tons)
Target Prov.				
Irrigated				
Spring	523,040	72	140	73,226
Winter	130,760	18	200	26,152
Rainfed				
Spring	68,300	10	100***	6,830
Subtotals	722,100	100	147	106,208
Afghanistan				
Irrigated				
Spring	1,277,990	52	140	178,919
Winter	319,498	13	200	63,900
Rainfed				
Spring	864,416	35	100***	108,052
Grand Total	2,461,904**	100	140*	350,871

\# Based on current recommended seeding rates being used;

* Average

** Exceeds most common used figure of 2.3 million hectares due to rounding off and use provincial figures based on irrigated and rainfed area figures from 1967-68 (Anon., 1989)

*** Used in Afghanistan based on previous results. However, the author's experience and results in other rainfed situations report higher seed rates due to seed losses experienced as a result of poor germination, especially in broadcast sowings.

The realistic assessment of the quantities of seeds to be produced depend on many factors and interact with quality issues. Consequently, the standards set or accepted for seed will vary slightly with the circumstances. In an emergency situation farmers may accept any wheat seed, but in more normal settings the correct variety and purity become determining factors on whether farmers are willing to pay for new seeds. Experience shows that the standards commonly used for wheat seeds internationally are acceptable to farmers in general (Hepworth, 1988). These standards should become the accepted standards for the AASSP/PSA. Higher standards exist for contracted certified seed. Purity levels may be as high as 99.9 percent. The higher standards should be negotiated with forward contracts.

Commonly accepted standards for wheat seed are:

- Genetic purity of 99% or 99.9% (depending upon class of seed)
- Germination 85%
- No living insects presents
- Weed seeds, 5-10 seeds/kg maximum
- Inert matter, 2% maximum

Another issue of importance to seed multiplication is the turnover or annual replacement rate. The announced rate varies with the country and sometimes even within countries. Some countries attempt to achieve very high rates such as 20 percent. This is excessive and probably impossible to achieve. A common stated replacement rate objective is 10 percent. In most incidents this is probably too high. A replacement rate of one to two percent would probably be a more realistic value. The control of quality at the lower rates would be enhanced and the total cost of the operation would be greatly reduced. A one percent infusion rate would be adequate to satisfy seed needs if local seed replacement is encouraged, and it is at a level sufficient for the introduction of new varieties.

A realistic rate for Afghanistan probably lies between one and two percent. It would be a reasonable figure to attempt at least in the early stages of the organization of the PSA unit. There is also the necessity to coordinate the other elements and inputs to the seed supply. The seed replacement percent can be revised upward each year as the capacity of the delivery system of the PSA develops.

Beside the difficulties and cost of delivering inputs, the rate of returning refugee farmers has been slowed. This will slow the projected need and demand for seed. However, the predictable supply of seed and inputs would probably serve as an encouragement for farmers to return.

Table 5. Calculated quantities of certified wheat seed (metric tons) needed each year for the 16 AASSP/PSA target provinces depending on the replacement rate in years and the % of area to be covered.

No. Years	Metric tons* of seed required per year depending on: % area and years					
	100%	20%	10%	5%	3%	1%
10	10,600	2,100	1,100	500	300	100
7	15,200	3,000	1,500	800	500	200
5	21,200	4,200	2,100	1,100	600	200
3	35,900	10,800	3,600	1,800	1,100	400
1	106,200	21,200	10,600	5,300	3,200	1,100

* Calculated from seed total for the 16 provinces

In Table 3. are some figures illustrating the internal rate of expansion for introduced seed, using some assumptions. The values used are based on an irrigated wheat model with a 140 kg/ha seed rate and exercising the recommended package of practices. A farm yield of 2.8 tons per hectare is assumed. This is slightly more than the irrigated wheat yield of 1978 and represents less than half the potential yield of the recommended system. It also assumes that only 10 percent of the production will be used or recovered as seed for expanding the acreage.

In the AASSP/PSA region the pre-war calculated wheat acreage was 722,100 hectares. If the ASA figure on reduction of acreage is applied, the current wheat acreage amounts to 505,470 ha. This area would require approximately 74,000 tons of seed for sowing. The injection of 1,000 tons of seed would cover approximately five percent of the area on current estimated acreage or five percent in about four years with pre-war figures (Table 6.).

New and additional wheat varieties are needed to diversify against the possible breakdown of the current varieties to the rust diseases. A plan to promote a shuttle breeding program with CIMMYT, Mexico is outlined which would develop a group of varieties with diverse rust resistances in the background of *Pak 81* and *Pirsabak 85*.

This appears to be a small effort compared to the need. However, the percent of seed re-purchase or quantity of contractual purchased seed at the bazaar level could be increased to 20 percent rather easily and have a sharp multiplier effect on both the number of farmers served and acreage covered. Seeds also move from farmer to farmer and this would have a positive influence. The productivity in the latter case may not be comparable unless the farmers are capable and willing to use other inputs.

An impact on area production would probably be recognizable in the third or fourth year after a single 1,000 ton seed shipment of other inputs continued to flow. A response may be seen earlier since approximately 3,000 tons of improved seed has already been delivered (FAO, 1989; personal communications Fitzherbert, FAO, Islamabad, Pakistan, 1990), and more than 2,000 tons were distributed within the AASS Project area. Another factor that will have an effect on production capacity has been the depressed yield which is bound to respond to inputs rapidly (Table 2.).

The programmed purchase of additional seed each year from outside Afghanistan will also increase the replacement rate and provide impact. If the PSA units delivery system can successfully place 1,000 plus tons of seed and necessary inputs with the farmers for the 1990-91 crop cycle, an upward adjustment in subsequent years should be relatively easy. The contract system via the private seed sector in Pakistan should be able to respond rapidly. The one requirement would be to make the judgement and decision at an early date so the system can respond.

An earlier recommendation was made to purchase 5,000 tons of wheat seed for importation in 1989. This was accomplished and approximately 3,000 plus tons were successfully moved into Afghanistan from Pakistan. There are 2,000 left in storage. Another recommendation was for the purchase and import of 15 to 20 thousand tons of wheat in 1990 and 50 thousand in 1991. In light of the difficulties encountered and the expenses involved it does not seem to be feasible to consider such large quantities. Experience with the 5,000 tons taxed the system to the limit.

The implementation of a smaller, more sharply focused seed import program seems more promising today. The import of 1,000 to 1,500 tons of seed for 1990-91 crop cycle would appear to be a more realistic figure to attempt considering all of the constraints and other demands involved.

The import of certified seed is a vital component to better seeds since it will provide the basis for internal distribution of improved seed. This import of wheat seed should be continued as a means and source of injecting a steady stream of quality seeds, and new varieties into the system. This procedure should be maintained until agriculture research in Afghanistan is re-instated to a level where Afghans can assume the responsibility required of an internal seed certification and production program.

Table 6. Assumed expansion of 1,000 metric tons of wheat seed over time using a ten percent expansion rate on seed from the production.

Yr.	Seed tons	Seed rate	Area 000 ha	Yield t/ha	Prod. tons	Return 10%
1	1,000	140	7,143	2.8	20,000	2,000
2	2,000	140	14,286	2.8	40,000	4,000
3	4,000	140	28,571	2.8	80,000	8,000
4	8,000	140	57,143	2.8	160,000	16,000
5	16,000	140	114,286	2.8	320,000	32,000

The import system should also be used as a mechanism for training Afghans in seed multiplication and certification procedures. This experience could then be transferred to Afghanistan when the opportunity arose. Other training opportunities provided by other institutions should be used to develop the talents of young Afghans. The International Centers such as IRRI, ICRISAT, ICARDA and CIMMYT all provide some training opportunities on different subjects with various crops. The ADT unit should help experienced Afghans identify such individuals for possible training. CIMMYT is in a position to provide training in breeding, pathology and production agronomy in the area of maize and wheat. In addition, training in experiment station management and economics is possible. Other institutes will offer similar topics with other crops.

The combined quantities of seed from contracted certified seed in Pakistan, the internal re-purchase quantities of improved seed (certified minus one season) and farmer sales should provide sufficient momentum to stimulate the demands for other inputs which could well become the constraint to productivity.

Recommendations:

- o The wheat cultivars recommended for the different zones in Afghanistan should be used by AASSP/PSA.

- o Seed quality should be maintained at the accepted international standards for certified seed and seed standards for improved seed in Afghanistan should be developed.

- o The seed replacement rate for the project area should start at a modest level between one and five percent, or at a quantity level of 1,000 to 1,500 tons of seed for the 1990-91 crop cycle.

- o The seed required should be obtained from either FAO/UNHCR or contract purchased from the private sector in Pakistan. This effort should be undertaken immediately for the coming season, 1990-91. In lieu of certified seed availability, contracting for quality improved seed should be arranged. There would still be time for scouting and selecting the better fields and arranging for removal of off-type plants and processing.

- o Future purchase of wheat seed for the project area should be for the irrigated regions and split 80 to 90 percent for spring types and 10 to 20 percent for winter types.

- o The acreage of spring sown wheat (March/April) is so small in the project area that purchase and distribution of *Sonalika/Blue Silver* cannot be recommended at this time. In the coming seasons small quantities of spring habit may be justified in the AASSP/PSA.

- o The VITA organization has contracted the purchase of approximately 500 tons of seed in the project area. AASSP/PSA should try to honor this commitment in order to maintain the good will of the farmers in the area.

- o The VITA contracted seed should be scouted and the necessary steps for removal of off-types of plants and harvest of the crop should be arranged so the best possible standards for locally produced seed are established.

- o Training of personnel who will serve as scouts or purchase agents for seed re-purchase should be arranged.

- o Seed storage to maintain the quality of purchased seed in the project area must be arranged.

- o Seed treatment possibilities for the purchased seed should be explored using the fungicide **Vitavax**, which will control two important diseases in Afghanistan. It is also a relatively safe chemical to use even at the farm level.

- o Seed cleaning and treatment equipment should be considered for each bazaar unit of the PSA.

- o The synchronization of the delivery of other inputs with the seed should be given priority consideration.

- o The use of mini-kits to distribute seed, fertilizer and other necessary inputs should be considered as an activity of the PSA and ADT jointly. The expense of quality seed distribution cannot be justified with the supply of fertilizer.

- o As new cultivars are identified, on-farm demonstrations should be developed by the ADT unit.

- o There is a need for new cultivars. The ADT unit should participate in the on-farm testing of these varieties and advanced lines should be identified by the research group.

- o Young Afghans should be identified for training opportunities with various crops available at the International Agricultural Research Centers.

Package of Practices for Irrigated and Rainfed Conditions:

In addition to the selection of the appropriate variety, the development of recommendations or a package of practices will be required if production initiatives are to be maximized. The following points are submitted as suggestions which can be used to assist in the layout and planning of on-farm demonstrations. On page 43, a copy of the summary page taken from Aslam et al., (1989) provides an example of the problem identification and response reactions the wheat production group should try to establish.

Seed Bed Preparation:

Land preparation is vital to good plant establishment which in turn determines how efficiently other inputs such as fertilizer and water will be utilized. Evidence suggests that

mechanized land preparation is superior and wheat yields are improved. Mechanization allows for more timely sowing, better weed control and improves water use efficiency. Experimental results show that the benefits of mechanized land preparation are greater in the rainfed areas than in the irrigated (Hobbs et al., 1989; Pickett, et al., 1968; Samin et al., 1968). Currently, there are some farmers in Afghanistan who are being forced to alter their sowing time from autumn to spring because of the lack of cultivation power and the difficulty of controlling weeds. This in turn causes other problems to increase such as moisture stress, insect, rodent and bird population build-up (Baquee and Tacon, 1989; Tacon, 1989).

Fertilizer Application:

Afghan soils are noted for their low fertility and require fertilizer to maximize yield (MOA, 1971; Pickett, et al., 1968; Samin et al., 1968; Swaminathan et al., 1979). One has to consider whether to maximize profit or return. In the current situation the cost of fertilizer is excessive because of transport costs. Recommendations should probably strive to achieve maximum return until sufficient supplies become available and prices stabilize.

Generally, wheat requires only nitrogen (N) and phosphorus (P). Potassium (K) has seldom given economic response with wheat but Swaminathan et al. (1979) suggests that application of K may be beneficial in Afghan soils. The need or value of K should be determined.

Without additional knowledge the rule of thumb used for irrigated wheat has been to apply two units of N to one of P. A good level in many irrigated situations has been to apply 100 to 120 kg/ha of N and 50 to 60 kg/ha of P_2O_5. To obtain a maximum return a lower rate may be worth considering such as 60 to 80 N kg/ha and 30 to 40 kg/ha of P. The rule of thumb for rainfed is to use a ratio of one to one for N and P. The level of fertilizer application will depend upon the available moisture. Recommendations vary from 20 to 40 kg/ha of N and P. Use 20 kg in the lower moisture situations of 300 mm rainfall.

Fertilizer can be applied as a basal application in most conditions. However, there are some situations, where split application may be desirable. In light sandy soils a split is often advantageous. A split may be useful if a good crop establishment is endangered or winter killing is a major concern. Under risk conditions the split application would save fertilizer and reduce costs. This is a common and reliable practice in many irrigated situations. It is seldom possible or feasible in rainfed situations.

The combinations of fertilizer and the responses to rates of fertilizer used to obtain maximum return or profit are suited to on-farm trials and/or demonstrations.

Sowing Time:

Each variety has a specific or optimum period for sowing. Often lack of land preparation, power or crop rotation may delay sowing in the irrigated lands. In the rainfed areas it is usually the lack of ability to prepare the land or the lack of rains. The value of establishing the optimum sowing time is important for yield considerations. In the case of a recent study in the Punjab of Pakistan the losses in yield from late sowing averaged 30 kg/ha/day for each day that sowing was delayed beyond November 15 (Aslam et al., 1989). It is worth mentioning that the winter wheat variety, *Bezostaya*, should be sown relatively early, between September 13 and October 10, to obtain the best results (MOA, 1971). The yields tend to decline when it is sown at later dates.

Irrigation:

Irrigation of wheat would normally supplement the winter rainfall. In a few locations sufficient rainfall is lacking so the crop is fully irrigated. There are two critical irrigations. The first is at crown root initiation stage. This is often the single most important irrigation in low rainfall areas. This irrigation establishes the crown roots or secondary roots for the plant. In dry soils they either do not develop or develop so poorly that the resulting root structure is inadequate to carry the plant. This affects the entire efficiency of the plant. This irrigation also takes place three or more weeks after sowing at moderate temperatures. The temperature will determine the timing based on the growth of the plant.

Other irrigations will depend upon a number of factors but generally if the plants are observed to show signs of wilting, irrigation should be applied. The other important irrigations are at flowering and early grain filling time. The latter irrigation is considered to be important for grain formation and test weight. Care needs to be exercised because the crop is very susceptible to lodging at this stage. Lodging readily occurs if wind is common at this time. Caution should be advised since the lodging may negate the benefit of the irrigation.

Weed Control:

Good weed control employs both agronomy and either cultivation or chemical removal of weeds. Many farmers use rotations or extra plowing to help control weed populations. Some farmers will remove weeds by hand, particularly, if they have sown their wheat in rows. Chemical weed control can be very efficient and cost-effective if weeds are considered a major problem. Broad leafed weeds are relatively easy to control with inexpensive herbicides such as 2-4-D and others. The grass weeds are more difficult to manage and chemical control is more expensive.

A major grass weed problem in Afghanistan is wild oats and it is difficult to control. There are some effective chemicals available. An interesting result from recent work done in the Punjab (Aslam et al., 1989) used chortóluron plus MCPA (Dicuran-MA) to effectively control both grass and broad leafed weeds. The herbicide combination was broadcast with either urea or sand. Good control was obtained with reduced rates, but careful application to insure uniform distribution was necessary. This would appear to be a very promising technology for parts of Afghanistan. For example, in some of the northern areas autumn sowing is being replaced by spring sowing because of excessive weed problems. This practice, however, brings other problems to bear such as moisture stress and insect problems (Tacon, 1989).

The ADT unit would be a logical organization to conduct on-farm trials using the above technology. If wild oats and other weeds are successfully controlled, then extension promotions and coordination of inputs via PSA would be enhanced.

Diseases and Pest Issues:

Diseases, insects, birds and rodents are major concerns and each can be serious (Ghaffor, 1970; Rovainen, 1978). The diseases of wheat have historically caused losses in yield and sometimes crop failures. The rust and bunt diseases are the most important and are widespread in Afghanistan. The seed varieties being recommended are considered resistant to the rust diseases. The genetic resistance of these varieties will prevent serious losses from occurring for varying periods of time. Eventually the resistance becomes ineffective due to the evolution of new races in the rust fungus. New varieties will have to be identified which possess either a new source or combination of resistance. This is an on-going process with the wheat rust diseases because of their capacity for change. Chemical control of the rust diseases will not be feasible under Afghan conditions because of yield levels encountered.

The wheat breeding program objectives are to develop better varieties with higher yield, more stability and the required disease resistances. The breeding processes should lead to a succession of new and better varieties. However, the screening and evaluation processes are central to the successful identification of useful cultivars. The ADT program could be a major contributor to this end by conducting trials on varietal evaluation within Afghanistan.

There is an urgent need for a higher yielding, disease resistant variety of seed for the rainfed areas in the lower elevations. There is also a need to diversify the varieties in the higher elevations. The variety *Bezostaya*, although adequate, has a number of deficiencies. It is red grained, a feature not appreciated in Afghanistan as it results in dark whole wheat flour which gives a dark nan. It is also awnless (lacks beards) which makes it subject to

increased bird damage if the surrounding varieties possess awns and the straw is also considered inferior for cattle feed.

The bunt diseases are also of major concern in Afghanistan, particularly at the higher elevations. There are resistant varieties but they may not possess the other characteristics required of a cultivar to become acceptable to the farmer. If resistance in an acceptable variety is not found there are chemical seed treatments available. They will effectively control the bunt diseases. The seed treatment with the chemical **Vitavax** is effective and safe. The ADT unit should become familiar with diseases and seed treatment procedures and extend this technology to the farmers.

Insects are a much more erratic problem in wheat albeit when they occur they usually require attention. Breeding for resistance to insect pests has not been effective and for polyphagous insects, impossible. This leaves only chemical and mechanical means for effective control should problems arise. A monitoring of insects and the chemical control procedures should be established. Farmers should be educated concerning insect control procedures. This is an obvious role for the ADT unit.

Rodents and birds have been increasing during the war period due to lack of any control measures being applied (SCA, 1988). The importance of rats, birds and even other animals in crop production can be significant. In the above reports rats and birds were recorded as the third biggest problem in crop production. This makes it a significant factor and control applications need to be delivered to the farmer. This activity suits the objectives of ADT as a source of information and PSA as a supplier of inputs.

Harvest and Threshing:

The technology of harvesting and threshing is dependent upon the machinery available or its absence and represents a major component of the cost of production. It will be of interest and concern to the PSA unit.

Storage:

The proper storage of grain to minimize losses from insects, rodents and microbes should be encouraged. Seed for the next year's sowing should be stored with extra care. Proper storage containers, conditions required for safe and extended periods and arrangements for the re-purchased seed in a project area must be arranged.

Maintaining improved seed at the farm level should be encouraged. The setting aside of a block of wheat which is intended for seed purposes should be proposed. From

this block the off-type plants or those that do not conform to the type should be removed and discarded, often referred to as roguing. All non wheat plants should also be physically removed. The block should be harvested separately and threshed first or separately. Mixing with other sources of seed should be avoided. The harvest should be stored separately from seed scheduled for consumption or sale.

Recommendations:

- The ADT unit of the AASSP/PSA should develop extension type information that will be conducive to wheat production.
- On-farm trials should be outlined and conducted taking into account important variables for wheat production. Coordination of experiments should be done in conjunction with research personnel and PPA.
- Farm demonstrations should be planned and executed to show farmers proven technologies for increasing wheat productivity.
- Training workshops should be organized to educate farmers in the application of new or different technologies.
- Survey and monitoring activities should be undertaken in order to develop baseline data and provide a feed-back system for assessment.
- The value of using a mini-kit type of extension package should be considered as a means of dispersing technologies about subjects other than seeds.

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II. SCOPE OF WORK

The Afghanistan Agricultural Sector Support Project/Private Sector Agribusiness requested Dr. Eugene E. Saari, leader of the Crop Protection Subprogram of the CIMMYT Wheat Program to serve as a consultant in Islamabad and Peshawar, Pakistan from January 11 to 29, 1992. The scope of work provided was:

- Work with the training staff for the wheat training component of winter training from January 12 to January 23. During this period, besides covering improved production practices, ways of estimating yields to predict Afghanistan's wheat productions should be described.

- Evaluate current programs and estimate the extent of improved seed adaptation in the wheat growing areas of Afghanistan.

- Evaluate and recommend a strategy for AASSP/PSA for determining a high altitude wheat variety for Afghanistan.

- Recommend programs for the next two and five years for Afghanistan.

- Suggest areas of collaboration with other organizations currently working in Afghanistan to increase wheat production.

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Notes of interest concerning Afghanistan

Units of measure in Afghanistan

seer = 7.0 kg

jerib / gerib = 200 m sq or 1/5th ha

1 seer/jerib = 35 kg/ha

Afghani = 1/20 th of a Pak Rs			Exchange values Feb. 1990
or 20 Afs	=	1 Pak Rs	
or 420 Afs	=	1.00 US $	

Terms used in Afghanistan

abi	Irrigated lands
karezes	A system of moving water using underground tunnels with vertical shafts used for maintenance
lalmi	Rainfed lands, non-irrigated land
mujihadeen	Afghanistan freedom fighters
shuras	Council or committee of local leaders

Distinguishing between the type/habit of wheat and time of sowing

Wheats are classified or referred to as either winter or spring wheat based on their manner of growth. Winter wheats are determined by requiring an extended cold period before they will bolt, flower and produce seed. They are characteristically tolerant of freezing temperatures as juvenile plants. They are referred to as having winter hardiness when they survive below freezing temperatures during this period. Spring wheats do not require a cold period to bolt, flower and produce seed. They are normally more sensitive to freezing temperature and are generally subject to winter killing when submitted to below freezing temperatures for any extended period of time. There is also a small group of facultative wheats which combines some of the characteristics of the two dominant groups. The terminology is frequently confused with sowing times and this can and has resulted in an inappropriate recommendation.

Copy of Table 2.5 from "*Wheat in the rice-wheat cropping system of the Punjab: A synthesis of on-farm research results 1984-1988*". Aslam et al., 1989.

Summary of major problems in wheat production and possible responses

Problem	Causes	Farmer response	Possible reach and extension response: Intermediate-term	Long-term
Poor Stand	Poor land preparation, crop residues. Farmer broadcasts seed. Moisture condition at time of seeding often not appropriate. Insufficient time after Basmati rice. Waterlogging and seedling injury if irrigated too early.	Attempts more tillage operations if possible. Waits for drying out of land to plant, causing late planting. Irrigates later and drains field after 24 hours.	Higher seed rate. Apply 1st irrig.later when seedlings less sensitive to waterlogging.	1. Better land preparation through alternative tillage implements. 2. Direct drilling in crop residues. Zero tillage. 3. Alternative cropping patterns.
Late planting	Insufficient time after harvest of Basmati rice and drying of rice in fields. The need to wait for appropriate moisture conditions.	Reduces land preparation. Favors IR-6 of earlier maturing rice varieties.	Screen wheat varieties for late planting and rice varieties for earlier maturity.	Direct drilling and zero tillage (as above). Alternative cropping pattern including rice and non-rice crops
Variety	Use of discarded variety, Yecora, which is susceptible to rust and also offers poor competition for weeds of short stature.	Seeds to change variety but encounters seed distribution and extension problems.	Verification/demonstration of new varieties. Set up seed distribution.	Study of seed distribution system and possible alternatives for reaching the farmer.
Weeds	<u>Phalaris</u> is a major weed of wheat. Growth is encouraged by poor stands and practice of continuously cropping wheat. Little hand weeding because of labor costs. Equipment not available for herbicide application.	1. Rotates with berseem to clear weeds. Limited by area of berseem. 2. Late planting and pre-irrigation to germinate weeds before wheat. However late planting itself produces lower yields.	1. Herbicide application in seriously infested fields.(Cost at current prices is about 500 kg/ha of wheat). Broadcast herbicide and reduce rate.	1. Better stand to choke early weed growth. Higher seed rate. 2. Mechanical control with bar harrow wheat is drill planted. 3. Canal maintenance to limit distribution of weed seed. 4. Study other ways to apply herbicide.
Poor drainage/ land levelling leading to waterlogging and uneven distribution of water	Puddling of rice fields leads to hard pan which inhibits drainage in wheat.	Priority given to practices which lead to a good rice crop at the expense of wheat.	1. Try use of deeper tillage (break hard pan.)	1. "Dry" planting of rice which eliminates puddling 2. Use of green manure crop rotation to improve soil structure. 3. Precision levelling of larger fields.
Poor application of N. fertilizer	1. Many fields with poor stands and weeds lead to reduced N.response. 2. Farmers often lack information on appropriate fertilizers and doses. Ratio of N to P_2O_5 in wheat is often to low. 3.Poor distribution of fertilizer in the field.	N-levels are continuing to increase. However, doubtful if higher dose of N is profitable unless stands are improved and weeds controlled.	Extension efforts on balance of N: P_2O_5. Possible reduction of P_2O_5 in favor of N. Analysis of fertilizer experiments by cropping pattern. Simple experiments to test P_2O_5 response.	1. Improved stands and weed control will lead to improved fertilizer response. 2. Possible mechanical fertilizer application to improve distribution in the fields.
High cost of harvesting and threshing.	Harvesting, threshing, and marketing accounts for 30% of total returns.	Some mechanical reaping to save harvest labor.		Analysis of constraints and implications of large scale mechanical harvesting.



Initial target provinces of the AASSP/PSA (DAI. 1989).

III. TRAINING COMPONENT

There are a number of publications which could be used as base training material for extension and other personnel connected with agriculture in Afghanistan. There are a limited number of training materials in local languages. There is a need to update some of the materials being presented and a large need for a **Manual on the Fundamentals of Wheat Production**. It would be of value if AASSP/PSA, in cooperation with other organizations, prepared such a manual first in English, then in Farsi and possibly other local languages. The possibility of doing this manual in cooperation with CIMMYT and possibly SCA should be explored. The advantage of including CIMMYT as a partner provides assurance that this publication will be available in years to come.

Another training area that should be considered is the development and production of video cassette training tapes. They represent a portable and strong teaching and training tool.

The procedures for gathering information on farm yields is a topic which deserves extensive discussion. The procedures are fairly well established and well known. Generally, surveys of farmers and extension agents can be done by questionnaires. The questionnaire should be pre-tested and standardized. Crop cuts are also a valid means of gathering yield information. It would probably be more effective to have teams trained that concentrate on this type of activity and give them special training. AASSP/PSA with its extension system should be able to gather this type of yield information without difficulty. This could be done in concert with the SCA survey work and would be complementary to their efforts. I strongly support such an effort and believe that AASSP/PSA should undertake this activity.

IV. EVALUATING PROGRAMS

The improved varieties of wheat seed being distributed appear to be well suited to the conditions in Afghanistan. The cultivars *Pak 81* and *Pirsabak 85* are adapted to sowing in November at elevations of 1800 meters and less. Both varieties may perform well when fall sown at higher elevations, but there will be possibilities for winter killing if the crop becomes exposed to sub-freezing temperatures for a week or a longer period. Fall sown *Pak 81* and *Pirsabak 85* will escape winter cold damage if snow cover protects them from sub-freezing temperatures, if sub-freezing temperatures are mild (minus 2 to 3^0 C), or of short duration (one or two days). Another danger of sowing early maturing varieties like *Pak 81* and *Pirsabak 85* in the autumn is the early heading date in the spring. Often this will expose headed or flowering plants to the late frosts of spring and cause plant sterility. A hard freeze can cause 100% sterility. Another concern expressed by Afghan farmers is the bird damage that occurs with early fields that are isolated from most of the crop.

In some cases late fall planting of the cultivars mentioned, will survive in the soil as seed and will germinate early in spring time. This may result in excellent yields which would even surpass the local autumn sown varieties. This is possible because of the high yield potential of the two varieties and their early maturing character. However, new high yielding winter habit wheats will yield even more than the spring sown ones in the areas suited for winter wheats. Additional planning and commitment are needed to bring about greater efforts to identify suitable cultivars for this area.

The cultivar *Bezostaya 1* has been distributed in the higher elevation areas (above 1800 meters) in limited quantities. It has performed reasonably, but has not been well accepted in all locations. This was predicted; it was recommended in 1989-90 because it was the only variety commercially available with a proven performance record, and a known safety record from disease and winter killing (Saari, 1989, 1990). Farmers in many areas do not like the red grain color of *Bezostaya 1*. Such beardless varieties are subject to more bird damage than bearded wheats and the straw characteristics are considered poor for animal fodder.

Testing of 1989 commercial cultivars available in other countries in the region of West Asia suggests that the variety *Atay 85* from Turkey is suited to the high elevation irrigated areas of Afghanistan (Dr. Azam Gul, personal communications, 1992). This variety should be promoted while the search for new and better cultivars continues. *Atay 85* is a high yielding cultivar, moderately resistant to stripe rust and resistant to stinking smut (bunt).

The need for cultivars in the high elevations suggests additional effort and support for the on-going research. The SCA is now processing new germplasm from both CIMMYT/Turkey and CIMMYT/Mexico programs as rapidly as possible. However,

additional on-farm testing of these potential varieties should be supported. The extension personnel of AASSP/PSA are able to undertake these activities.

The spring sowing (March and April) of *Pak 81* and *Pirsabak 85* at higher elevations (2000 to 2700 meters) will be possible with irrigation. These varieties are capable of high yields and are resistant to stripe rust which is a problem at these altitudes. In the future, we expect that there will be a need to diversify these varieties with new cultivars possessing additional sources of rust resistance. Another area of concern at the higher elevations is the presence of the disease stinking smut (often referred to as stinking bunt in the USA). This disease is both seed and soil borne, and is common in the higher elevations. It can cause substantial damage, and unfortunately both *Pak 81* and *Pirsabak 85* are susceptible. It would be most desirable to find alternative resistant cultivars to replace these two varieties since chemical seed treatment controls in the high remote areas are not very practical.

The stripe rust disease has serious repercussions to wheat production in Afghanistan. It causes severe losses when epidemics occur. Epidemics are possible when weather conditions are favorable for disease development, susceptible varieties are grown extensively and early infection of the crop occurs. This was the case in the crop cycle of 1990-91. A stripe rust epidemic occurred on the local varieties which still occupy the majority of the acreage. Local wheat production was disrupted to such an extent that food shortages and starvation were recorded. Some relief supplies were brought in from Iran and migration was experienced from the central highlands, areas hardest hit by the epidemic. Most of the migration was to Iran because the area affected involved Shiite Moslem communities which associate with the Iranians. This epidemic did not receive much attention because of the Gulf War in 1991.

The value of improved varieties is well illustrated by the stripe rust epidemic that occurred in 1990-91. In a discussion with Mr. Mark Pont of Afghanaid in Peshawar, and a preliminary review of results from the Afghanaid program activities in Kapasi Province, the improved seeds (*Pak 81*) out-performed the local cultivars by a large margin. The area concerned involves Panjshir Valley with elevations ranging from 2000 to 3000 meters. The review involved 30 paired comparisons between local and improved varieties. All 60 plots recorded were sown in spring (March or April). The 30 fields of improved wheat in the survey reported no rust. Twenty-five of the 30 corresponding fields sown to local varieties registered severe rust. Only five fields of local varieties escaped or were not recorded to be infected. Interestingly, the variety known as *Mexipak* (an introduced semi-dwarf of Mexican origin from the late 1960s and early 1970s) was recorded as a local cultivar. A quick review of the yield comparisons between improved and locals indicated a 50+% yield advantage for the improved varieties.

A survey done by AASSP on yields of *Bezostaya* and local varieties in Logar gave similar results. In yield comparisons, *Bezostaya* yields were 4040 kg/ha in 1990 and 4430 kg/ha in 1991. In contrast, local varieties averaged 1790 kg/ha and 580 kg/ha in 1990 and

1991 respectively. It was reported that the disease stripe rust was the main reason for the yield reductions in the local varieties in 1991.

A questionnaire given to the trainees at Peshawar by E.E. Saari indicated similar results and the potential seriousness of stripe rust. According to the extension trainees the stripe rust disease was a serious problem in the provinces of Zabul, Paktika, Paktia, Ghazni, Oruzgan, Bamyan, Wardak, Logar, Parwan, Kabul and Kapisa. The disease was particularly severe in the provinces of Logar and Wardak. In the case of Wardak the killing of the crop was registered by several extension agents. The yield difference was also substantial with improved varieties yielding as much as five times more than local varieties.

A real concern is emerging over the extensive cultivation of *Pak 81* and *Pirsabak 85* in both Pakistan and Afghanistan. The popularity of the two varieties with farmers suggests that they will continue to spread. There are indications that new rust races are evolving which could overcome the resistance of the two related cultivars. Experience in other countries indicates that both varieties can become susceptible to new races of rust. It is only a matter of time before such races of leaf rust and stripe rust evolve in either Afghanistan or Pakistan. There is a growing urgency to develop a strategic program to develop a group of varieties with additional resistances which can be substituted for *Pak 81* and *Pirsabak 85*.

A program of shuttle breeding using *Pak 81* and *Pirsabak 85* as base parents is a sound undertaking. The effort would involve sending visiting scientists to CIMMYT, Mexico at critical periods for planning and selection of germplasm developed from a joint backcrossing program involving the two cultivars. The selections in Mexico would be for yield and rust resistance. The next generation would be done locally in both Pakistan and Afghanistan. The local selection criteria would be for adaptation, yield and type.

With a sharp focus and commitment, an array of cultivars based on *Pak 81* and *Pirsbak 85* with diverse sources of resistance could be available in a five year period. Both Pakistan and Afghanistan scientists should be included in the effort. Pakistan will be in need of varieties to diversify its acreage because of the extensive cultivation of these two varieties. In addition, Pakistan is still a backstopping agent in agricultural research for much of Afghanistan. The costs would be nominal and the potential pay off large for such a project. Basic support for the travel of four breeders and pathologists each year to Mexico and exchange visits by CIMMYT scientists would be the major costs.

V. RECOMMENDATIONS

5.1 Recommended Strategy

The high altitude areas of Afghanistan account for a relatively small portion of total wheat acreage. Most estimates place this area at 15% or less of the total. The greatest potential for improvement is in the lower areas. Opportunities for short term progress are also greater in the lower areas where technology for the areas is readily available.

Where fall sowing is possible at high altitudes, wheat varieties that are true winter to strong facultative winter types are required. In the past, a consistent source of adapted winter hardy varieties was not readily available. The majority of winter germplasm that has been developed came from Europe and North America. These cultivars were somewhat more specifically adapted and were not directly useable in Afghanistan.

CIMMYT, in cooperation with the Turkish Government, has a joint program to develop winter and facultative germplasm suitable to regions such as Afghanistan. There are a number of new wheat lines becoming available each year through the International Winter and Facultative Wheat Screening Nursery. This nursery is available to Afghanistan and represents a potential source of new varieties. However, these are all experimental lines which need to be evaluated locally, and tested for yield and adaptation. Seed of experimental lines are limited, therefore quantities of seed would not be available elsewhere. A seed multiplication program would have to accompany the selected lines.

The initial evaluation and selection of lines from introductions of wheat have been the responsibility of research scientists. Currently the SCA in Peshawar has accepted much of the responsibility for germplasm introduction and evaluation. The testing of promising lines in yield trials in different regions of Afghanistan, extension demonstrations of new varieties and seed multiplication of new wheat varieties at the farmer level will need additional support.

The need for more and better quantities of improved wheat seed is enormous. The area thus far sown to new cultivars is nominal. The SCA's **The Agricultural Survey of Afghanistan**[1] probably has as extensive and valid information regarding improved wheat seed use as can be found anywhere. The figures in some cases seem high but in other instances, depending on the province, the values are quite low. In contrast, a brief questionnaire circulated by E.E. Saari to extension personnel doing training in Peshawar suggests the area involved is still low. In the questionnaire, the area sown to improved

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[1]. **The Agricultural Survey of Afghanistan** Twelfth Report 1990 Survey, November 1991, The Swedish Committee for Afghanistan, Peshawar

varieties ranged from a maximum of 20% to a low of 0. The results from an AASSP/PSA survey of extension staff in 1990 suggests a slightly higher maximum of 25%. This low percentage would be understandable considering that the total amount of improved seed that has been distributed is relatively small. Probably less than 15,000 metric tons of seed has been distributed, and it appears that internal multiplication and promotion of seed is still nominal. Another error is that some agents consider *Mexipak* as an improved variety. It should not be considered in this manner because it was introduced before the war and it has now become susceptible to the rust diseases.

The need for additional and continued quantities of improved wheat seed is self-evident. There continues to be a need to import from outside of Afghanistan a nucleus stock of pure seed of the approved wheat varieties. This nucleus stock will be relatively small in quantity because of purity demands, cost and transportation issues of delivering into Afghanistan. An additional mechanism to provide the needed multiplier effect of this nucleus seed must be found or created.

5.2 Recommended Program

The continuing need for good seed and the demonstration of the package of practices remain paramount to the successful increase in wheat production in Afghanistan. There is a need to carry out a locally focused system of seed multiplication, to develop a basic on-farm demonstration and trial system which can be continued with other sources of support, and to encourage the supply of inputs since they will continue to be required.

Simple demonstrations should be proposed under the existing conditions. Trials such as the package compared to the farmer practices is the basic comparison. Another simple example would be a four way comparison involving oxygen, fertilizer, nitrogen, phosphorous and nitrogen + phosphorous laid out in a quadrant. Other more complicated designs are possible but for now, simple demonstration trials will suffice.

The standards imposed on wheat seed are rigid and, for Afghanistan, excessive. A limited amount of mixture should be tolerated and described. The new tolerance limits would allow a greater flexibility and increase the supply of available seed by a substantial margin.

A seed multiplication project different from conventional systems is the best way for a significant multiplier effect to be generated on seed stocks. AASSP/PSA should establish the basic parameter for a new class of seed for seed marketing channels. It should be possible to implement such a seed class in the Afghanistan context in the next two years. I would recommend a tolerance level of 95% genetic purity, 85% germination, less than 1% insect damage or presence, 10-20 weed seeds maximum and inert matter of less than 5%.

ASSESSMENT OF WHEAT PRODUCTION

January 1992

DAI

Development Alternatives, Inc.

ASSESSMENT OF WHEAT PRODUCTION

IN AFGHANISTAN

AND RECOMMENDATIONS FOR FUTURE ACTIVITIES

January 1992

Prepared For:

**OFFICE OF THE AID REPRESENTATIVE
FOR AFGHANISTAN (O/AID/REP)**

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